

<https://helda.helsinki.fi>

Small nation, big ships winter navigation and technological nationalism in a peripheral country, 1878-1978

Matala, Saara

2017-06

Matala , S & Sahari , A 2017 , ' Small nation, big ships winter navigation and technological nationalism in a peripheral country, 1878-1978 ' , History and Technology , vol. 33 , no. 2 , pp. 220-248 . <https://doi.org/10.1080/07341512.2017.1343909>

<http://hdl.handle.net/10138/225731>

<https://doi.org/10.1080/07341512.2017.1343909>

cc_by_nc_nd

publishedVersion

Downloaded from Helda, University of Helsinki institutional repository.

This is an electronic reprint of the original article.

This reprint may differ from the original in pagination and typographic detail.

Please cite the original version.



ISSN: 0734-1512 (Print) 1477-2620 (Online) Journal homepage: <http://www.tandfonline.com/loi/ghat20>

Small nation, big ships winter navigation and technological nationalism in a peripheral country, 1878–1978

Saara Matala & Aaro Sahari

To cite this article: Saara Matala & Aaro Sahari (2017) Small nation, big ships winter navigation and technological nationalism in a peripheral country, 1878–1978, History and Technology, 33:2, 220–248, DOI: [10.1080/07341512.2017.1343909](https://doi.org/10.1080/07341512.2017.1343909)

To link to this article: <http://dx.doi.org/10.1080/07341512.2017.1343909>



© 2017 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



Published online: 29 Jun 2017.



Submit your article to this journal [↗](#)



Article views: 182



View related articles [↗](#)



View Crossmark data [↗](#)

Small nation, big ships winter navigation and technological nationalism in a peripheral country, 1878–1978

Saara Matala^a  and Aaro Sahari^b 

^aHistory of Industrialisation, Aalto University, Espoo, Finland; ^bFinnish and Nordic History, University of Helsinki, Helsinki, Finland

ABSTRACT

Finland is the only country in the world where all ports freeze over during a typical winter. Over the century 1878–1978, Finland developed a winter-seafaring system that broke the winter isolation and eliminated seasonal variation in shipping. By using diverse archival sources, we deconstruct the dominant narrative of Finnish winter seafaring through which national as well as technological development is often presented as natural, inevitable and straightforward. We reinterpret the Finnish winter navigation system as a tangible, historical experience and show that technological solutions in this domain cannot be understood outside the context of a decades-long process of nation-building. Finally, we argue that winter navigation became a central imaginary for Finland as a western, industrial and modern nation. As such, the Finnish winter-seafaring system presents a case of technological nationalism in which a small, peripheral country sought to integrate itself into a modern international order.

KEYWORDS

Nationalism; Finland; winter seafaring; icebreakers; technology transfer; large technological systems

Introduction

‘Finland is an island and all of its ports freeze over during a normal winter’ has been an oft-repeated saying in Finnish discourse.¹ It makes natural the idea that this northern country is both strongly dependent on icebreaking and particularly capable of managing its wintry condition. In order to eliminate seasonal variation in trade, Finland operates an icebreaking fleet that is second only to the major Arctic countries, Russia and Canada. This article discusses the development of the Finnish winter navigation system over the century, 1877–1977. We argue that the deterministic, nationalistic narrative from ice to icebreakers fails to capture the complexity of Finnish history. Finland is not an island and icebreaker-assisted winter seafaring was not the only means of transport. Mere industrialisation and export trade fails to explain why winter navigation became perceived, to invoke the terminology of Thomas Hughes, as a reverse salient in the late nineteenth century. Nor, does it explain why, during the twentieth century, the Finnish state directed significant public

CONTACT Saara Matala  saara.matala@aalto.fi; Aaro Sahari  aaro.sahari@helsinki.fi

© 2017 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.
This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives License (<http://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited, and is not altered, transformed, or built upon in any way.

resources, again and again, to these expensive, special purpose vessels, which saw limited use only for three to four months in a given year.

We study the decision-making in winter seafaring committees, government organisations as well as the public discussion related to icebreaker acquisitions. We are interested in the explicit arguments and implicit presumptions in these discussions: how the decision-makers perceived the function and role of icebreakers in the Finnish national infrastructure system and their relation to national identity. We then revisit the classical presentations of the history of Finnish winter navigation to understand how the dominant nationalistic narrative about icebreakers was constructed and established.

In the late nineteenth century, Finland was not a sovereign state but a part of the Russian empire and was practically isolated from Western Europe during winters. We argue that icebreakers became important because a nationalistically minded technocratic elite saw them as a technology that could greatly contribute to their nation-building efforts, thus making Finland the modern, Western country they wanted it to be. Nationalism, economic and political incentives were inseparable components in this process.²

Building the winter seafaring system was a contested process. In order to shield it from political uncertainty, a threefold strategy emerged. First, a range of economic, political, and industrial stakeholders were invited to participate in policy-making. Second, the decisions they made were made to seem natural through a widely shared technocratic rhetoric. Finally, both the system and the rhetoric were presented as a success story that resonated with other aspects of Finnish national narratives. As a result, icebreakers became not only necessary for the economy and national well-being but also ‘monuments of collective identification.’³ In fact still today, they are seen as something inherently Finnish, brave and innovative.⁴ As such the development of the Finnish winter navigation exemplifies how technocratic beliefs and nationalism were intertwined projects.

Technological nationalism shapes development by providing governments the justification for supporting technological projects that demonstrate strength and prowess. Meanwhile technology contributes to national identity by performing critical symbolic work: presenting a sense of collective self-sufficiency, by constructing a shared narrative of community, and distinguishing a nation from others.⁵ Technological nationalism is, in fact, often understood through gigantic, heroic projects undertaken by big countries to accrue prestige and demonstrate technological prowess in international forums.⁶ Peripheral and late-coming countries are typically seen as uninteresting and passive adaptors of technology transferred from centres.⁷ We contribute to the literature of technological nationalism by presenting a case from a small country that did not have financial or intellectual resources comparable to big and advanced countries but an equal desire to define itself through technological progress. A century-long period of focus enables us to study how these national meanings given to a technological project transformed through time.

For this purpose, we analyse the winter navigation system through the concept of ‘large technological systems’, initially devised by Thomas Hughes.⁸ The Finnish system was built from many components, including icebreakers and ice-capable merchant ships, their manufacturers and users, research facilities, ice classifications as well as legal innovations. Following Hughes, as this system matured, various political-economic-technological issues arose. Within this analysis, ‘system builders’ recognised these as ‘reverse salients’ and took action to overcome them. In developing this large technological systems, Finnish actors through technocratic rhetoric and practice created an increasingly intimate relationship

among, engineers, industrialist, and politicians.⁹ Identifying the central decision-makers, system builders, and their main motivations, allows us to analyse systemic values that shaped the development of the Finnish winter navigation system.

We use a variety of sources to deconstruct the history of the Finnish winter navigation system. We draw on public records from various government agencies, mainly the Finnish maritime administration¹⁰ and the ministry of trade and industry¹¹ as well as various cabinet and ministry committees. To see beyond institutional boundaries, we also incorporate material from private archives of key participants, ranging from politicians to ship constructors and public maritime figures. These sources, we argue, demonstrate the socially constructed nature of icebreakers, as symbol and artefacts, and their relation to Finnish aspirations as a modern nation.

The article is divided into three parts, which correspond to key phases in Finnish history as well as the changing role of technology transfer in Finnish industrialisation. The first part of our story, 1878–1917, is one of transnational technology transfer from Western Europe and the United States. At that time, the Grand Duchy of Finland was a part of the Russian Empire. It had no history as a national unit, but a nationalistically inspired cultural movement¹² had begun to construct the idea of a separate Finnish nation. The importance of cultural symbols, political rhetoric and economic connections in shaping Finnish national self-understanding during this early period is generally well recognised in the histories of Finnish state- and nation-building.¹³ The search for and adoption of technology to overcome tangible problems of connecting Finland to the larger world has become muddled and obscured by later nationalistic narratives. In the second part, 1917–1945, winter navigation becomes a preoccupation of the newly independent Finnish state. Between 1918 and the Second World War, the expenses of winter navigation were hotly contested while a slow but noticeable increase in icebreaking capacity took place. In the context of national storytelling, though, icebreaking became important by showcasing indigenous technological capability instead of mere technology transfer. Such advance promoted but did not establish an international image of Finland as a modern western country. Finally, in the third part, 1944–1978, we describe the overwhelming expansion of winter navigation resulting from the widespread acceptance of the icebreaker as a crucial technology to ensure Finland's ties with European countries during the cold war. Finland now rapidly transformed from an agricultural to an industrial country. Simultaneously, the capability to eliminate seasonal variation in shipping became accepted as a natural and necessary feature of Finland as a modern country.

Inventing a nation of winter seafaring

We the outpost of Europe against the nature/among the ice is our laurel wreath burnished/and we reap our bread out of the ice and the snow.¹⁴

Two concurrent shifts in shipbuilding were fundamental for the early period of this analysis: the transition from sail to steam and from wood to iron and steel enabled the building of ships that were better able to withstand the pressure of ice, giving rise to visions of uninterrupted seaborne traffic in Europe and North America in the mid-nineteenth century.¹⁵ The first steps in building a special-purpose icebreaking vessel occurred in economic shipping centres such Philadelphia, Hamburg and St. Petersburg.¹⁶ Finland was still a poor, peripheral

region both in relative and absolute terms. Connections to Europe were cut every year for months by the onset of winter. The crop failure in 1867 demonstrated the consequences of isolation imposed by nature. With winter lingering on and grain ships unable to bring relief, some 110,000 people starved to death or fell to illness in the last great Finnish famine. The tragedy not only amplified calls for industrialisation and security of supply but also gave momentum for overcoming the problem of winter isolation.¹⁷

Most of Finnish population and economic production were, and still are, concentrated on a headland surrounded by two long bays of the Baltic Sea, the Gulf of Bothnia in the North and the Gulf of Finland stretching eastward towards St. Petersburg. Both freeze over in the winter (Figure 1). This natural fact separates Finland from other winter navigating countries, such as Sweden, Russia and Canada, which all have some ports open all year long. From the point of view of logistics and in the absence of railways and other means of international transportation, Finland indeed resembled an isolated island in the nineteenth century.¹⁸ Given the tangible effects of natural forces in everyday survival, it is not surprising that both contemporary and later commentators start their narratives with reference to these geographical imperatives in the development of the Finnish icebreaking.

Nevertheless, the decision to acquire the first icebreaker for Finland in the 1880s did not inevitably rise from geographical restrictions or economic necessities. Icebreakers were not the only possible technology for ensuring winter international traffic. From 1870 onwards, railways connected Finland to the imperial capital of St. Petersburg providing a secure means to supply grain in winter. While shipping was nigh impossible during the height of winter, the sea ice surface did allow lighter traffic across the Gulf of Bothnia to Sweden. A postal service had been run with horse-drawn sledges to and from the eastern Swedish provinces in Finland in the eighteenth century.¹⁹ Still, with the sea-lanes blocked by ice, the exporters of important commodities such as butter and timber could only hope for an early spring to access markets in Germany and the United Kingdom.²⁰

Icebreaking – as a publicly funded service for export trade with purpose-built ships – was established only gradually in an on-going negotiation with the aforementioned other options.²¹ Given foreign examples of icebreaking ships, Finnish industrialists and politicians redefined the winter embargo as a solvable technological problem instead of an insurmountable natural condition. The strongest advocates of Finnish icebreaker procurement were supporters of stronger western connections and Finnish economic independence from Russia for political and economic reasons.²² Doctor Knut Pipping, a Finnish railway booster, had already distilled the issue in 1861 by calling for courage and faith in future in infrastructure and communications technology development:

[Finland] as a country, that only lately has begun its life as a Finnish nation, whose only recently risen self-confidence gives grounds for optimism, shall not allow disbelief and depression to frighten it off to make transient sacrifices, with which it must buy its future grandeur.²³

Throughout the 1860s and 1870s, numerous Finnish newspapers published articles on the ‘ice-breaking question’, arguing the feasibility of ice navigation in general, presenting the best technology for doing so, and highlighting the role of the public sector in organising winter navigation. Albin Stjerncreutz, the assistant director of the Finnish pilotage service responded to Pipping’s optimism by stating: ‘every sensible man has to understand that winter navigation in the southernmost Finnish port of Hanko will forever remain a dream.’²⁴

Despite this very public debate, a group of private businessmen decided to try winter navigation from Hanko to Stockholm in 1873. They built a private railway connecting this



Figure 1. Finnish ports and the Baltic region showing Finland's borders at different times and the approximate extent of sea ice in winter. Continuous arctic ice rarely reaches Scandinavia. Source: © Aaro Sahari CC BY 4.0.

rural fishing village to the national network and St. Petersburg in the hopes of extending the navigation season. Competing against Russian Baltic ports further south, the Hango gamble didn't pay off and within two years the company went bankrupt, having failed to attract sufficient traffic from other parts of Russia. The Finnish Senate stepped in and bought the Hango port and railway, thus establishing the harbour as the primary winter gateway to and from Finland. Then in 1877, another group of private businessmen launched a regular shipping route between Hango and Stockholm, using an ice-strengthened passenger ship 'Expressen II'. This venture went bankrupt as well, but again the Senate funded a new state-run operation to keep the service going. The ship had room for 26 passengers and a small amount of cargo, managing approximately four to five round trips in a winter.²⁵

At the same time, the technical development of winter navigation was taking place in Germany, the Nordic Countries, and on the east coast of the USA where the demands of traffic were greater and environmental conditions milder. A purpose-built icebreaker emerged from these experiments in the 1870s.²⁶ The growing Finnish export industry pushed for more government involvement to ensure regular, reliable, and affordable trade. Doctor Pipping had already echoed this sentiment in a newspaper article, stating that 'without well-being we have no future and without connections we have no well-being'.²⁷ Despite

being small and lacking in cargo capacity, 'Expressen' proved to public officials that winter navigation was not merely a dream. The Senate founded a pilotage committee in 1885 to plan the purchase of an icebreaking vessel that could maintain connections to Sweden throughout the winter.²⁸

Impatient for results and wanting to press the issue, in 1889, the leading forestry magnate G. A. Serlachius and the director of the state economic and industrial office Leo Mechelin invited the Baltic's most advanced icebreaker, the Danish 'Bryderen', to visit Hanko to demonstrate the usefulness of this new technology.²⁹ Moved by the display of a ship overcoming the environment, the journalist K. A. Tawasjerna wrote that:

We were overcome with pure patriotic and hopeful feelings. This modern mechanical struggle against the ice meant more to our country than any other battle to have taken place thus far on its white snowy banks. There the liberation from chains of poverty and frost approached us in the form of the two black steamships. We celebrated the victory of the human-genius against prejudice and the tough, cold nature of Finland.³⁰

The stunt led to hoped-for results. Newspapers noted the visit with optimism declaring the 'end of the icebreaking question'. Indeed, 'Bryderen' marked the turning point in the Finnish debate. The harsh winter of 1888–1889 proved other means of icebreaking – such as explosives or ice saws – incapable of keeping the port of Hanko open. Also from this moment onwards, the issue of winter navigation was closely linked to the interests of Finnish forestry and shipping industries. Acting on the advice of the economic and industrial office, the Senate decided to place an order for an icebreaker with Swedish Bergsunds machinery works,³¹ and on Christmas Eve, 1889, the first Finnish icebreaker was ceremoniously named after the Danish ship as 'Murtaja' (the Breaker).³² Icebreaking was an emerging technology at this point and few engineers or ship constructors had any experience of it. Consequently, Bergsunds ended up following pre-existing Danish and German plans in designing the ship.

'Murtaja's' maiden voyage to Finland was delayed until late spring 1890, when there was little ice left to run tests and prove the icebreaker's worth. The Finnish public met the ship with mixed feelings. Journalists described the Grand Duchy's most expensive ship as a 'magnificent iron giant', but also as 'clumsy-looking steely egg', the 'worst floating sea-pig in the world' or as an 'elephant'.³³ Regardless of its odd appearance, questionable technical capacity and economic feasibility, all newspapers could agree that the ship represented progress with its electric lights that 'transformed the heavy giant into a brilliant fairy-tale ship', lighting up the capital, Helsinki, from 'the dock to the top of the steeple' (Figure 2).³⁴

This first Finnish icebreaker did not mark a breakthrough in actual winter navigation. 'Murtaja's' design was based on prevailing European ideas on icebreaking that soon became obsolete in the 1890s. These ships were spoon-shaped in order to rise on top of the ice sheet and crush it under their weight. When 'Murtaja' had to cut through snow-covered banks, it tended to get stuck, and in open waters it heeled and pulled unpredictably. All in all, the government icebreaker service considered the ship generally difficult to handle.³⁵ Still the icebreaker did, by and large, do what it was meant to do, even if it failed to meet high public expectations. These mixed results focused discussion in all major Finnish newspapers on the potential of icebreaker technology to support western trade.³⁶ Despite its defects, 'Murtaja' established the icebreaker as necessary infrastructure and a symbol of technology overcoming the harsh natural constraints. As a leading newspaper put it: 'Murtaja will fight with us against the winter and she will win. That is why she is our friend'.³⁷



Figure 2. Icebreaker 'Murtaja' opening a way to port for sailing ships in a black and white reproduction of late eighteenth century painting by Herman af Sillén. Source: © [Deceased 1908, see Swedish Act on Copyright in Literary and Artistic Works, 1960:729]. Reproduced with the permission of the Finnish National Archives.

The Finnish association for technology³⁸ now took on the challenge for developing winter navigation prowess. Activist engineers Robert Runeberg,³⁹ Karl Bonsdorff and John Eager together with Baron K. E. Palmén dominated the increasingly technical discussion in the 1890s and came to lead the Senate committee on winter navigation.⁴⁰ These socially well-placed, Swedish-speaking technologists found a willing audience in the Finnish Senate and among the public. Runeberg and Palmén documented the development of winter seafaring technology in a pair of influential articles published by the association and circulated in the Senate.⁴¹ Meanwhile, Bonsdorff took a publicly paid trip to Chicago for the World's Columbian Exposition in 1893 and found a solution to the Finnish icebreaker question on the Great Lakes.⁴² The Detroit naval architect Frank E. Kirby had recently designed two new icebreaking ferries, 'Mackinaw' and 'Ste Marie', to help the local forestry industry. After observing two tugs operating bow-to-bow in heavy ice, he came up with a two-propeller design – one for each end of the ship. Bonsdorff was able to visit these ships and copy drawings to bring back home, thus spearheading importation of the American type of icebreaker to Europe.⁴³

On the advice of the committee and with the backing of the exporters, the Finnish Senate decided to order a new icebreaker in 1897. The tender was placed with the well-known and respected British shipyard Armstrong Whitworth, which had built several ships for the Russian navy among others.⁴⁴ As a result, the icebreaker 'Sampo'⁴⁵ was one of two built by the shipyard in 1897–1898. The Russian navy also ordered the world's largest purpose-built icebreaker 'Jermak' for the Baltic fleet. A decade later, the Grand Duchy bought a second

Sampo class icebreaker, 'Tarmo' (Vigour, 1907) from the Newcastle yard. Despite the obvious national importance of icebreakers, their procurements from foreign shipyards went relatively unquestioned. Only a few nationalistic journalists suggested the procurement of new icebreakers from a domestic shipyard, but their arguments were overruled by immediate economic considerations rather than concerns over using the technical experience of leading European yards.⁴⁶

Relations between the Grand Duchy of Finland and the Russian Empire became volatile around the turn of twentieth century as the latter pushed for pan-Russian civil and economic centralisation much to the chagrin of Finnish nationalists. The ability to conduct export trade free from Russian infrastructure became both a political and an economic imperative in Finland. Even though the railway route to Russia was not as vulnerable to winter conditions as the maritime routes to the West, it had limited economic significance due to similar production structures in Finland and Russia. As an administratively independent unit, Finland also had a customs border with Russia. As a result, two thirds of Finnish foreign trade went to Germany, Great Britain, and the Nordic Countries rather than the imperial capital. The share of Russian markets for Finnish foreign trade grew only during the First World War due to war economy and restrictions on Baltic trade. Between 1917 and 1919, the Finnish paper industry controlled 30% of Russian markets and exported 80% of its total production there.⁴⁷

On the threshold of war, the three Finnish icebreakers were taken over by the Russian Baltic Fleet, leaving merchant shipping without assistance. This underlined the fact that without sovereignty and its own icebreaker fleet Finland's connections with the Western Europe were still dependent on Russia. Leading Finnish shipping magnate Lars Krogus had already become the leader in shipping policy and continued to promote domestic control and government subsidies to guarantee the expansion of the maritime trades.⁴⁸ This set the tone for the coming decades. A small technologically minded group of individuals was able to convince the central administration in Helsinki that publicly operated icebreakers were an efficient and essential way of connecting Finland with Europe throughout the year.

Plotting the national course

As the conditions, in which our winter seafaring is executed, are becoming more dire, it is necessary to devise a definite program with which to develop the icebreaker question. Instead of focusing on any individual polemical issues, the whole program and its future implementation should be discussed.⁴⁹

Finland gained independence amid the confusion of the Russian Revolution in 1917. After undergoing a harrowing civil war the next winter, the now independent state of Finland slowly transitioned to a changed, post-war international political and economic environment. The forestry industry looked for opportunities in the West – most notably in the UK – while shipbuilding fell into a decade-long depression. Finnish shipping continued to rely on foreign built second-hand tonnage. Shipping companies even placed orders for more advanced ships to European shipyards as a global shipbuilding downturn swept over an industry plagued by wartime production glut and post-war cancellations and decreasing prices.⁵⁰ A few substantial liner companies dominated Finnish shipping in the 1920s and 1930s. The greatest among them was the Finnish Steamship Company⁵¹ (FÅA). The aforementioned Lars Krogus had led the company to expansion but now gave way to doctor

Henrik Ramsay – a new key member of the maritime lobby.⁵² FÅA facilitated connections between the newly reformed Finnish maritime administration (MKH) and European shipyards in the 1920s.⁵³

Navigable routes through the ice-covered Baltic Sea regained their pre-war priority for the forestry in the 1920s. The growing size of freighters shipping pulp and paper set new requirements for the size of icebreakers.⁵⁴ When the Treaty of Tartu between Finland, Estonia and Soviet Russia confirmed the Finnish-Soviet borders in 1920, the Republic of Finland received the area of Petsamo⁵⁵ and its ice-free port of Liinahamari⁵⁶ on the Arctic Ocean. Nevertheless, this direct access to ice-free seas remained a theoretical option, as the railway network ended in Rovaniemi some 500 km of wilderness away from the Arctic coastline.

Through the 1920s and 1930s, Finland's uncoupling from Russia further increased the dependence on western maritime routes and consequently icebreaker service became an expected function of the state. The expensive, domestic development of such specialised technology was still unthinkable in 1917. In the early years of independence, the 'Finnishness' of icebreaking technology was still embedded merely in the ownership and function of the icebreakers instead of Finnish construction or design. The commandeering of 'Tarmo' amid the revolutionary turmoil in 1918 provides an example. The icebreaker was in Russian naval hands when Helsinki was taken over by Finnish reds during the civil war. To 'save' the ship, a group of Finns, led by the centrist senator P. E. Svinhufvud, commandeered the icebreaker and delivered it to the whites. Along the way, 'Tarmo' exchanged gunfire with a Russian icebreaker. While this was a minor event in the history of the Finnish civil war, in later retellings it was integrated into the nationalistic liberation myth.⁵⁷

It took the Finnish government years to make headway on creating an indigenous capability to build icebreakers. The forestry industry, in particular, pressed the ministry of trade and industry into action. The issue of icebreaking spilled over to the media with various maritime and shipbuilding specialists fighting over different possible solutions. Finally in February 1923, the minister for trade and industry, Aukusti Aho, called a meeting to decide the future of Finnish winter seafaring. The list of participants is indicative of the gravity of the issue: the forestry industry general council and strongman Axel Solitander; Krogius and Ramsay representing not only their companies but also numerous other interest groups; Gustaf Wrede, director of MKH; as well as import, home-market and whole-sellers associations' directors alongside specialists in maritime trades and shipbuilding. In short any union, interest group or sizeable company with even an indirect interest in the matter was present. Together they laid out a plan for Finnish winter navigation comprised of three new icebreakers that would guarantee uninterrupted traffic to the southernmost ports of Turku, Hanko and Helsinki. Ramsay proved victorious in the debate as a voice of moderation, as the MKH pressed for more ships while leaders for domestic market interests sought to limit using scarce public resources on icebreakers. During this process shipbuilder K. A. Johansson emerged as the leading Finnish specialist trusted by the ministry and the MKH to oversee the procurement of new ships.⁵⁸

An old ship was bought from Turku and renovated. The 'Apu' (Assistance) was the smallest of the programme. Meanwhile a half-finished icebreaker was bought from the logistics company John Nurminen. Engineer Johansson initially designed the ship at a Reval yard in Estonia but now continued his work in Finland. This icebreaker 'Voima' (Force, 1924) was given a bow propeller per established government requirements set in the aforementioned

meeting, but the added expense was met with a lively and critical debate on government spending. Johansson carefully documented these developments in a black notebook.⁵⁹ Despite concern over costs, the government decided to extend an international tender for the world's largest, sea-going icebreaker, requesting that Johansson develop the specifics. Over twenty depression-stricken shipyards across Europe responded to the 1924 tender, with the contract finally awarded to the P. Smith Jr. shipyard in Rotterdam. The yard had recently built two ice-going cargo ships for FÅA, and its chief engineer consulted on Finnish icebreakers. This alone didn't help the Rotterdam yard to victory though. As a bitter British competitor later complained to UK officials, the Dutch shipyard had received significant public subsidies from the Dutch state and the city of Rotterdam, enabling a very low bid.⁶⁰

At the same time, the Finnish maritime cluster began to organise. In February 1925 the first Finnish maritime affairs congress was convened in Turku.⁶¹ The FÅA chairman Krogius stated in his ceremonial opening statement that because government and public opinion had failed to grasp the importance of maritime trades in Finland, those present should together find the means to advance both shipping and shipbuilding industries in Finland. He also pointed out that, though governmental assistance was needed for certain auxiliary tasks, such as naval operations, the industries themselves should be first and foremost in solving the current predicament. Krogius therefore reaffirmed his previous position on the issue, as stated in earlier committee findings in 1912.⁶² During the discussion, it soon became evident that shipping interests were opposed to public subsidies on domestic new-builds, which were widely used to direct private ship orders to domestic shipyards. Though the privately owned Finnish shipping companies did not want the state regulating from whom they should buy their tonnage, they did agree with the shipyards that the state should support domestic shipbuilding by buying all government ships from Finnish shipyards. Small municipal and private harbour icebreakers, however, were not included in this discussion on public support until the 1930s.⁶³

In order to enable winter traffic, the state icebreaker system needed to be complemented with vessels that were able to follow the icebreaker through the channel it cut in ice. The first technical requirements for commercial vessels used in winter seafaring in Finland were published in 1930. They were based on international shipping insurance classifications. A vessel that belonged to the highest class in open water navigation got ice-class II, whereas the special ice-going ships received ice-class I. As the navigation fees commercial ships were obliged to pay depended on their ice-class, the ships with the highest class were freed from icebreaker fees.⁶⁴

Meanwhile the Finnish Navy was able to drive through an ambitious new-build programme with the help of the maritime cluster in 1925–1927. While the Navy had no icebreakers, between 1927 and 1935 its orders helped to save the Turku and Helsinki shipyards from the Great Depression and to prepare them to build more advanced, technically complex icebreakers. In particular, building submarines and pocket battleships with German aid and technological know-how, these shipyards gained competence that enabled the construction of the first truly domestic icebreaker, the 'Sisu'.⁶⁵ Ordered from the Helsinki Shipyard in 1936, it took almost three years to build due to various construction difficulties and cost overruns. The same people, who had been in charge of the earlier Voima project, designed the ship – most notably engineer Johansson, now the director of the shipyard.⁶⁶ 'Sisu's' design had been influenced by development in Sweden, where the 1933 'Ymer'⁶⁷ had become the first diesel-electric driven icebreaker in the world and as such was paraded not only to

the Finns but also to various other foreign officials, the United States Coast Guard among them (Figure 3).⁶⁸

In the Second World War, Finland lost both the war against the Soviet Union and its access to the Arctic Sea. Even though Finland was not occupied, the harsh terms of the peace, war-reparations, and the proximity of the St. Petersburg, shadowed the post-war years. Immediately after the war, Henrik Ramsay took it upon himself to write the history of Finnish winter navigation. Due to his career at FÅA and his public service, Ramsay had ready access to domestic and international informants. Now he also had time, as he had been sentenced to a term in prison as a cabinet minister in the 1946 war indemnity trials. It seems he chose this topic because it resonated with his political and personal ideas about Finland's struggle against geography and towards independence.⁶⁹

While preparing his manuscript, titled, *I kamp med Östersjöns isar*,⁷⁰ he was in contact with Johansson, the Swedish maritime bureau, and various experts in Denmark, Germany, and the USA. His history became the narrative touchstone for linking icebreaking technology and the creation of Finland as a modern nation. Ramsay's exchanges with his peers reveal a person on a mission to associate the icebreaking profession with the imagined Finnish national character. Like the early nationalistic journalists, Ramsay considered Finnish winter navigation as 'a prerequisite, an indispensable requirement, for the development of the Finnish economy and civilization'. While compiling earlier sources with a nationalistic point of view, he emphasised Finnish natural-born mastery in fighting the ice, especially in comparison to foreigners. As an example, Ramsay referred to the travelogue of a British adventurer E. F. Clarke about his passage across the Sea of Åland with Finnish



Figure 3. Public officials, diplomats and naval officers aboard icebreaker 'Sisu' in Helsinki South Harbour in front of the presidential palace during the Second World War. Source: © [Unknown photographer, Henrik Ramsay Private Archive, free under Finnish Copyright law 49 a § 8.7.1961/404]. Reproduced with the permission of the Finnish National Archives.

postal couriers in 1800. While Clarke called the postmen a bunch of lazy cowards, Ramsay explained this as the Englishman's inability to understand the treachery and dangers of the winter sea. In addition to winter navigation, Ramsay paid attention to Finnish engineers and their contribution to the early development of icebreaking technology. Ramsay also overemphasised Johansson's role in designing icebreakers and eventually turned an international story of technology transfer into a story of Finnish engineering ingenuity.⁷¹

The influence of the Ramsay narrative has been significant, as nearly all writers commenting on the history of Finnish winter navigation have repeated it almost verbatim.⁷² Throughout the seventy years from the national awakening to the first decades of independence, icebreakers had functioned as powerful symbols of modernisation superseding backwardness. Starting with Ramsay, Finnish icebreakers were 'Finnish' not merely due to their ownership or their function in support of maritime traffic, but also because of their technology as something original and special to Finland – something that differentiated this small country from others. Though factually this latter claim was at least suspect for the first half of the twentieth century, it still served as a powerful national narrative.

Naturalising icebreaking

The purpose of icebreaking is to keep all winter ports open throughout the year, even on the harshest of winters, when the Baltic is almost completely iced over ... as a consequence, the icebreaker fleet must be matched to the worst of times above and beyond the needs of milder winters.⁷³

After the Second World War, Finland – still a relatively peripheral country in the European context and a latecomer in terms of industrialisation – started a rapid structural transformation, despite its politically delicate cold war situation. Extensive bilateral trade with the Soviet Union raised the value, production volume and political significance of metal manufacturing in economic policy considerations as well as in foreign affairs. Exports to the Soviet Union comprised approximately 15–20% of the total Finnish exports. Because of railway connections east, icebreaker-assisted shipping was not as crucial for this trade as they were for western exports. Finnish-Soviet trade did not diminish the importance of the western-oriented forestry industry nor of icebreaking. On the contrary, western exports delivered badly needed convertible currencies to Finland and countered political and economic dependency on the Soviet Union. Several Finnish cold war historians have shown that negotiations on European tariffs and customs had a crucial role in Finnish foreign policy efforts in developing and maintaining connections to the West.⁷⁴ Cold war Finland 'breathed with its ports' more than ever and trade connections with the West became crucial when dealing with the East.⁷⁵

Finland's troubles next to the Soviet Union evoked sympathy in the Western world but as Helge Jääsalo, the director of MKH, later noted the markets do not reward the courageous and relentless efforts of an incompetent industry.⁷⁶ In order to be competitive, the forestry industry needed cost efficient, continuous and reliable maritime transportation throughout the year. Unfortunately, Finland had lost the best part of its merchant marine to the Soviet Union as war reparations in 1944. The largest state icebreakers 'Voima' and 'Jääkarhu' were also relinquished, significantly diminishing Finnish icebreaking capacity. At the same time, the war reparations necessitated an unprecedented ship construction programme that forced the government to jumpstart industrial expansion in this previously depressed and

peripheral industry. The forestry sector and the MKH almost frantically demanded that new icebreakers be built to restore pre-war capacity.⁷⁷

The winter of 1946 was bleak and the inflow of western aid was stymied by the strong Baltic ice barriers. Again, natural conditions made icebreakers a critical policy issue. The Paasikivi cabinet established a committee to design a new state icebreaker and plan the tender on 31 January. The severity of the issue was such that the Ministry of Trade and Industry chief of staff and former naval commander Svante Sundman was named committee chairman. As he was also the director of maritime affairs at the ministry and from 1948 onwards the director of the war reparations administration, Sundman was perfectly placed to press the issue. He called on engineer Johansson to participate as the committee's technical specialist, while MKH, as the future recipient of the icebreaker, named its chief engineer Ossian Tybeck to the committee. Unfortunately as he and Johansson were by all accounts on bad terms, Tybeck didn't participate substantially in the design work. In March 1947, the committee recommended the purchase of a sea-going icebreaker that could assist large cargo ships, but as shipbuilding resources were tied to the war reparations until late 1952, the construction of a new icebreaker had to be delayed.⁷⁸

Global shipbuilding was booming in the late 1940s, and Finland lacked foreign funds to even entertain the idea of ordering the ship from abroad. As a result the Helsinki Shipyard won the tender as the sole reasonably experienced domestic yard. The new state icebreaker, 'Voima',⁷⁹ was finally completed in 1953, following construction issues that had plagued the shipyard and grated relations between Johansson and his former subordinates. As the first, big, modern icebreaker designed and built in Finland, 'Voima' was touted as a distinctively Finnish feat of engineering. At launch it was the biggest, most modern icebreaker in the world with diesel-electric engines able to produce 10,500 shp⁸⁰ for its four propellers. Two of these were at the bow, where they increased the water flow between the hull and ice, thereby decreasing friction. The propellers, together with a wider hull and more powerful engines allowed 'Voima' to assist large cargo ships on longer trips through the Baltic thus keeping Finnish winter navigation capacity in line with changing ship technology.⁸¹

Convinced of its success with the icebreaker 'Voima', the Helsinki shipyard made a strategic decision to invest in further specialisation in the design and building of ice-going vessels and achieved worldwide reputation as the builder of modern icebreakers (Figure 4).⁸² Abroad, these giant, high-tech vessels soon became visible showpieces of Finnish industry and competence.⁸³ However, the way Finns presented their icebreakers abroad, contrasted strongly with the political struggles and public debates they were being subjected to in Finland.

Public officials helped the shipyard by reframing the icebreaking issue. The board of public transportation published its new findings on winter traffic in Finland in 1957 proposing a 'rational' way to organise the national infrastructure system.⁸⁴ For the first time the calculations included cargo traffic data from different ports as well as an estimation of environmental effects. During the post-war reconstruction, this kind of technocratic planning and Taylorism superseded earlier national romantic approaches in public management.⁸⁵ This strengthened the foundation of political support for state icebreakers to include not only the interests of export industries or Ramsay's emotive nationalistic arguments but also 'rational cost-efficiency' as justification for increasing investments in winter navigation. The board concluded that merely keeping up present icebreaking capacity would necessitate new construction and as increase in traffic and ship sizes were expected it would be most



Figure 4. Icebreaker 'Voima' on the Gulf of Finland in the winter of 1954. Source: © [Niilo Aljasalo, Wärtsilä Helsinki Shipyard, FMM collections, published with CC BY 4.0 licence]. Reproduced with the permission of the Finnish Maritime Museum.

effective to buy two new smaller ships in addition to 'Voima'. To keep costs down, regional cooperation with Sweden and the Soviet Union was also recommended. The committee considered the expansion of winter seafaring capacity self-evident noting that:

It is in the interests of the state to take a more active part in the management of winter traffic. As there seems to be no opposition to this in principle, it falls down to the means with which to achieve a nationally economically beneficial result.⁸⁶

As long as the Finnish winter navigation discussion was focused on the Finnish industry's access to western markets, there was a broad agreement that the public sector should maintain a sufficient number of icebreakers to connect the southern winter-ports to the Western shipping routes in order to guarantee a fair competitive position for Finnish forestry in comparison to other Western European countries. This goal gave an economic rationale for the icebreaker-building programme. The winter transportation board agreed that Finland as a country could not afford winter stoppage in exports and estimated that expanding the icebreaker fleet was a more cost effective instrument to support continuous transportation than alternative means such as railways. The MKH received five new icebreakers during the two decades after the war. However, only two of them, the 'Voima' and the 'Tarmo' (1963), were sea-going Baltic icebreakers of over 10,000 shp.⁸⁷

The new icebreaker did not eliminate seasonal variations. In an average winter, ports in northern Finland were closed and cargo was carried by rail to open ports in the south of the country. While the political and economic importance of state icebreakers had become self-evident, the debate now revolved around the issue of their optimal number and the rational organisation of winter transportation via the southern ports. In fact, the winter transportation question focused more on railways than icebreakers before the mid-1960s.⁸⁸ Emergence of bigger and more powerful icebreakers in the 1960s shifted the debate as to

whether to keep the Gulf of Bothnia ports open during the height of winter. Thus, through a series of steps the number and capacity of state icebreakers became both a central symbolic and practical activity for connecting Finnish conceptions of a modern state.

The two northernmost provinces Oulu and Lapland covered almost half the country but were inhabited by less than one eighth of the population. Their economy was historically built on poorly productive agriculture and hampered by long distances, inadequate infrastructure, and lack of capital. Forestry was still spread out all over the country and would remain that way, but increasing mechanisation in a variety of industries and agriculture spurred urbanisation. Fewer hands were needed in timber harvest when using chainsaws and trucks, while the threshing machine and the tractor cut employment in agriculture. Consequently, previously agrarian people were moving south to industrial centres.⁸⁹ The Finnish agrarian party, led by President Kekkonen, sought to counter this southward trend within the country for the continuance of its political legitimacy. For Kekkonen, coming from northern Finland, the governmental intervention in the economic development of the North was not only necessary to support the national economy but also essential in bringing these remote regions to a level with the rest of the country.⁹⁰ The expansion of the icebreaker fleet was therefore not a mere technical problem or just an economic issue, but essentially a flash point for a political struggle on the future of Finland as an integrated country. The debate over icebreakers was a proxy for a discussion on equality between Northern and Southern parts of the country.⁹¹

As winter lockdown increased transportation costs and unemployment levels soared, local industrial companies, labour unions and the representatives of port towns along the Bay of Bothnia vigorously endorsed winter navigation. Meanwhile allocating taxpayer money to keep the northern ports open was opposed by the southern port towns and the state-owned railway company VR, both arguing that these limited resources would be more optimally used if they were invested in railways and a few southern winter ports. Shipping and insurance companies were concerned with increased ice damages and the resulting repair costs caused by strong pack ice. Even if state icebreakers were now strong enough to open routes to the northernmost ports, the majority of commercial vessels were not strong enough to use them. Lars Beckman, the chairman of the Finnish Marine insurance association, argued that ice damages incurred north of Vaasa were on average twice as expensive suggesting that these might be uninsurable losses:

If it is known in advance that a voyage to a port behind the pack ice barriers is not possible without relying on icebreaker hauling and if it is also known that the vessel will suffer from serious damages, we are precariously near the limits of insurable risks.⁹²

When Helge Jääsalo⁹³ was appointed as the director of MKH in 1964, the Finnish icebreaker fleet got an enthusiastic spokesperson. He was personally interested in developing winter navigation and often travelled on one of 'his' icebreakers.⁹⁴ During a particularly severe winter in 1966–1967, when even some of southern ports were closed down, Jääsalo was able to get the government to approve the purchase of two new Tarmo-class icebreakers: 'Varma' (Sure 1968) and 'Apu' (Aid, 1970).⁹⁵ The 1960s winter transport debate was triggered by the development of these increasingly powerful and cost-efficient icebreakers that consequently made the extension of navigation season to and from the ports north of Vaasa on the Gulf of Bothnia technically feasible.

The MKH was responsible for deciding which ports were to be kept open, while Parliament effectively controlled the size of the icebreaker fleet through budgetary oversight. All sides of

the winter navigation debate actively lobbied both in public and informally through personal networks using extensive reports and position papers to justify their points of view. These presented different kinds of arguments on the total cost of various modes of transportation within the national transportation system. As it is often the case with big and complex political decisions, these accounts did not provide unanimous or unambiguous answers.⁹⁶ Although the various participants in the discussion argued that their 'rational', economic and technical calculations superseded their opponents' 'sentimental' and 'regional' considerations, the social construction of ostensibly technical and economic facts seemed to be apparent to those involved. As an example, the leading Finnish maritime journal *Navigators* noted that the winter navigation debate was an example of how 'seemingly reliable-looking numbers can be used to justify one's own opinions while "nicely forgetting" some relevant factors' which did not support their argument.⁹⁷

In retrospect, the year 1970 appears as a watershed in the icebreaker debate. The Bank of Finland published an extensive report on winter transportation emphasising the power of 'objective' and 'rational' comparisons between different transportation systems. Some of the implications of this study merit closer inspection. Firstly, the report assumed the primary unit of analysis was the national economy as a whole and that it was the bank's role to take that perspective. It argued that the procurement of two new icebreakers would lower public infrastructure and social costs overall. In doing so, the report shifted the responsibility for uninterrupted maritime traffic further to the state from private interests. Secondly, the report assumed that the icebreaker fleet should be capable of maintaining reliable traffic flow 'independent of weather conditions' thus lowering overall risks to the economy. As Baltic Sea winters are not alike but the extent and the strength of the ice-cover changes considerably from year to year, the icebreaker fleet necessary for especially harsh winters would be distinctly oversized for most years. The report refers to these fixed capital costs of unused icebreakers as 'insurance for reliability'.⁹⁸

Although Jääsalo presents the Bank of Finland report in his memoirs as the main contributor to the solution of the icebreaker discussion (gaining agreement from historians later on), the influence of this single study should not be overemphasised.⁹⁹ Before the publication of the report, he had already declared that MKH aimed to keep all major Finnish harbours open during normal winters from Hanko in the south to Kemi in the north.¹⁰⁰ His confidence was not affected by the fact that the current icebreaker fleet was still insufficient to reach this goal. Moreover, Jääsalo's ambition can hardly be supported by the Bank of Finland report, as it explicitly states that keeping the ports up north open throughout normal to severe winters is technically possible, but economically infeasible and 'as an instrument of regional policy, too expensive and inefficient'.¹⁰¹ Despite Jääsalo's claim in his memoir, the political debate and friction over icebreakers was not fully resolved.

Despite these inconsistencies in reporting, the Finnish icebreaker fleet attained just this capacity by 1975. The two new Finnish icebreakers, 'Urho'¹⁰² (1975) and 'Sisu' II (1976), marked the beginning of a new era in Finnish winter navigation, where, in principle, shipping was now independent of winter conditions.¹⁰³ If the economic calculations were not enough to justify the investments, how did this turn come about? Through a close reading and comparison of multiple sources, we argue that there is no single cause, but that different factors interacted to bring about expansion and change. The powerful president Kekkonen and his agrarian party supported Director Jääsalo's relentless pursuit of nationwide preparedness. This led to a clear power shift in favour of MKH over the state railways. Through

his unrelenting advocacy of icebreakers as a critical means to building a modern Finnish state, Ramsay made a lasting impression on the MKH director, who saw himself as part of a grand tradition by stating that: 'What brave men have started, was left to economic and technical men to develop further'.¹⁰⁴

Other important factors are related to the technological development in icebreaking and the aforementioned issue of maritime insurance. While promoting new icebreakers, the MKH also collaborated with its Swedish sister organisation, the shipyards, and classification societies to renew insurance classes for ships operating on the Baltic.¹⁰⁵ The existing ice-class requirements had been revised in 1960s, but they still rested upon assumption on ice-mechanics from the 1930s. The requirements were based on outdated assumptions in metallurgy and ship strength theory. Especially the ice strengthening required for the highest IA Super-class was thought to make a ship too heavy and too expensive, while not significantly increasing its ability to navigate through ice. Only a couple of such ships were ordered because of the excess costs of building.¹⁰⁶ The new Finnish-Swedish ice-class requirements, implemented in 1971, were reformulated based on latest research. They increased the requirements for hull strength and engine power required in the lower classes, but loosened requirements for the highest IA Super class. The ships in the two highest ice-classes were freed from icebreaking assistance fees and those in the highest class received a reduction from general navigation fees. This became a remarkable economic incentive to shipping companies to upgrade their fleets. The share of ice-strengthened vessels in the Finnish merchant marine started to grow steadily and provided companies a strong footing on domestic transport markets.¹⁰⁷ Consequently, both the costs of ice-damages and the critical attitude of ship owners towards winter navigation on the Gulf of Bothnia began to decrease.

That all major Finnish ports are now kept open throughout the winter every year did not happen without political conflicts and compromises. Winter navigation has also been strongly shaped by technological developments that opened new cost-efficient possibilities for the export industries, which in turn called for increased reliability in shipping. The technological and economic facts used to justify new icebreaker procurements always



Figure 5. The Finnish five Mark coin, depicting the icebreaker 'Tarmo', became the highest denomination coin in 1971. The designer wanted to explicitly break the romantic notion of Finland as a country of nature and farmers. Source: Talvio, *Suomen rahat*, 101–3. The picture presents the 1979 renewed version with the icebreaker 'Sisu' © (Mint of Finland) Reproduced with the permission of the Mint of Finland.

were intertwined with ideology. Integral to the icebreaker question was the idea of Finland as a Western, modern and interconnected country. Icebreakers were not mere tools in developing this idea but also dramatic symbols of its success (Figure 5). In 1978 MKH decided to celebrate Finnish winter navigation. To justify the festivities and to ensure public interest, MKH declared the day the privately owned passenger steamer 'Expressen' had resumed operation in 15 December 1877 as the birthday of Finnish winter navigation. The landmark was celebrated with jubilees, commemorative stamps, and a book from doctor Jorma Pohjanpalo.¹⁰⁸ For Ramsay in 1949, the history of Finnish winter navigation revealed an inconsistent effort to take sea ice as a critical national problem. Now in 1978, less than 30 years later, that history was presented as long and glorious.¹⁰⁹

Conclusion

During the century 1878–1978, Finland created a winter navigation system that effectively broke the power of winter over everyday life. At the same time, the country transformed from a non-independent, backward region on the edge of Europe into a sovereign, modern European country. In this article, we have argued that the development of the extensive winter seafaring system cannot be explained without understanding the intentionally interwoven aspirations for a modern, nation state and the winter navigation system.

Initially between 1878 and 1917, growing foreign trade and increasing demand for security of supplies throughout the year framed the Finnish seasonal isolation from continental Europe as a national reverse salient. Technological development abroad transformed winter sea ice from a natural fact into a technologically solvable challenge. During this first stage, the system builders were Finnish nationalistic-minded fennomans, technocratic industrialists and engineers who managed to muster limited available intellectual and material resources for a complex national project before the nation was a nation state. Finnish icebreaking was not a direct result from ice as a defining condition in Finnish life. A combination of political, economic, and cultural factors made strengthening connections with the West – instead of Russia – essential to national decision-making in the Grand Duchy 1878–1917.

The idea of Finland as a modern country was a relevant component in the winter navigation discussions throughout the period. The historical actors shared a willingness to develop Finland and have it considered a modern industrial country. Consequently, they chose to use icebreakers as a suitable and practical means to manifest this desire. Icebreakers fit well with the national romantic idea of the Finnish people heroically mastering over harsh nature and completed the picture of Finland drawn by artists. Even the first icebreakers were able to do something no other Finnish ship could: they were able to fight against geographical conditions. Such tangible tools enabled a technological version of nation-building.

During the second period 1918–1947, economic nationalism shaped the transition of Finland from a Russian province to an independent country, affecting legislation, the role of state-owned companies and patriotic management.¹¹⁰ As Niklas Jensen-Eriksen has pointed out, economic nationalism did not lead to protectionism in Finland, but instead supported the building of a relatively open and increasingly export-oriented industry.¹¹¹ In a small country with restricted home market demand, increasing exports was the primary way to expand industrial production. Export industry brought work, capital and technology to the rural backcountry. Thus, industry was not just about economy. The technocratic elite considered it crucial for making Finland the modern country they wanted it to be. That is

why the big, expensive public investments in icebreaking were considered justified despite the small size of the public sector.

During the inter-war period, icebreakers became accepted as a visible example of Finnishness at home functioning as a material tool to strengthen social ties within a fractured nation. Towards the end of the period, a coherent national story of Finnish winter navigation started to take form. The narrative translated the original history of technology transfer and transnational cooperation into a national heroic story and linked technological decision-making with a preferred history. This nationalistic perspective on technology was focused on successful applications of foreign technology and their role in enhancing national welfare, not on technological self-sufficiency. Icebreakers were 'Finnish' through their operation in Finland and for Finland, not because they would be built in or developed by Finland.¹¹² The necessity of Finnish winter navigation did not bring about a Finnish icebreaker construction industry. Nationally important vessels were bought from more advanced shipbuilders abroad during early decades of winter navigation.

The third phase of the development 1948–1978 turned the focus from ensuring uninterrupted shipping to ensuring uninterrupted shipping in all major Finnish ports. Though icebreakers were already accepted as a fundamental component of the national infrastructure, the number, function, and reach of the icebreaker fleet was a subject of a fierce debate. The numerous reports and studies aiming to provide a 'rational' solution to the winter navigation question were often conflicting in their recommendations. Purely technological and economic arguments are not enough to explain the final conclusions: A modern country should ensure ongoing shipping from both southern and northern Finland, and to afford 'the insurance for reliability' in shipping in the form of extra icebreaking capacity. Two individuals, President Kekkonen and director Jääsalo, were especially important during this stage. The question of opening northern ports was undoubtedly a political tool for both of them. Kekkonen advanced his stated regional policy in the North, while Jääsalo strengthened MKH within the Finnish public infrastructure sphere. Importantly they were able to raise enough parliamentary support for new icebreaker acquisitions through the widely accepted idea of a modern and westward facing Finland and elimination of seasonal variation as its reverse salient.

In the Finnish case, the meaning of technological modernity seems to have followed a particular trajectory: from appropriation of technology through transfer and use during the first period before independence, to technology application and utilisation during the inter-war period of the second period, and finally to independent development in the post-war years. Icebreakers were engaged in building a certain form of an imagined Finnish community but their role varied in meaning and significance from the late nineteenth to late twentieth centuries. In our story, three aspects of the Finnish national idea became highlighted: Finland as a Western country, Finland as a modern society and Finland as an integrated nation. That the Finnish national idea is today understood as industrial rather than agrarian, Western rather than Eastern, and modern in a European sense was a contested process.

Nationalistic rhetoric aimed to give meaning to the past, the future and the present through storytelling that gave the nation form in time and space. Icebreakers became one such story in Finland. While they did not drive the national history of Finland, the ideal of winter navigation provided a flexible and appropriate object with which to present and

give form to ideas of the nation. The aforementioned actors presented the Janus face of nationalism as a simultaneous view to the past and the future, inwards and outwards.

While the issue of Finnish winter navigation is small in terms of resources and geographical impact in comparison to commonly perceived projects of national prestige, it manifests a clear case of technological nationalism. Finnish engineers and politicians recognised an issue, sought an answer and developed solutions that were not as relevant to other technologically more advanced countries. This process connected Finland to and differentiated it from other modern industrial countries. The notion of Finland as the nation of winter seafarers and icebreakers lives on to this day. We suggest that this icebreaker mythology persists because it aligns neatly with Finland's dominant notion of its distinctive place in the world.

Notes

1. Laurell, *Höyrymurtajien aika*, 381; Laurell, Riimala, and Sandbacka, *Through Ice and Snow*, [2], 64; Pohjanpalo, *100 Vuotta Suomen Talvimerenkulkua*, 366, [4]; Turunen and Partanen, *Raakaa voimaa*, 198; Matala, "Läpi kylmän sodan ja jään," 25; and Kaukiainen, *Ulos maailmaan!*, 585. Finland as an island was also the title of the 2017 Maritime History symposium celebrating 100 years of Finnish independence and held at the Finnish Maritime Museum.
2. In this article we will not contest the commonly shared and internationally recognised notion that Finland is presently a modern. The close connection between nation building and technological modernization has been contested in research. As Finnish national identity started to take form in the middle of the nineteenth century, many of the Fennoman leaders feared that further industrialization would increase foreign influence in Finland and ruin the genuine agrarian culture thought to represent the original 'Finnish nation'. For example, Karl-Erik Michelsen has argued that Finland's technological modernization should not be seen as a national project but rather as a private industrial enterprise motivated by attempts to improve its social status and welfare. (Michelsen, *Viides sääty*, 81–3.)
3. Russell, "Steamship Nationalism," 313–34.
4. Tekes – the Finnish Funding Agency for Innovation teamed up with the Dudesons group of daredevils in 2017 for an icebreaker themed PR campaign with the following introduction: 'It takes courage to be a Finn. Finns are brave, ambitious and dare to do things differently. Finns are well-educated professionals with high productivity. Just take a look at these examples. Did you already know Finland is the Coolest Innovation Hub in Europe? If not now you see it.' <https://www.tekes.fi/en/programmes-and-services/campaigns/dudesons/>, accessed 8 May 2017.
5. Fridlund, "De nationalistiska systemen," 77–103. National technology projects often merges national goals with economic and technical interests. In this way, it come near to the concept of 'physical patriotism' Sverker Sörling has used to describe the role of Swedish natural resources as the base for national identity building in the international context. 'Fysisk patriotism'. Sörlin, *Framtidslandet*.
6. Josephson, *The Conquest of the Russian Arctic*; Hughes, *Rescuing Prometheus*; and Fritzsche, *A Nation of Fliers*.
7. Hecht and Allen, "Introduction"; and Clayton, "SCOT: does it answer?" 351–60; Technological nationalism in a small country is usually examined from the point of view of technology transfer and self-reliant technological development, and evaluated in terms of how well such a country succeeds in adopting foreign technologies and retaining technological autonomy. Myllyntaus, *Electrifying Finland*; and Michelsen, *Valtio, teknologia, tutkimus*.
8. Hughes, *American Genesis*, 381–442; Hughes, "The Seamless Web," 281–92; and Hughes, "The Evolution of Large Technological Systems," 51.
9. Hecht, *The Radiance of France*, 28–31; and Hecht, "Planning a Technological Nation," 134–41.
10. Merenkulkuhallitus.

11. Kauppa- ja teollisuusministeriö.
12. Nationalistic movement known in Finnish as *fennomania* or *fennomaaninen liike*.
13. Pulkkinen, "One Language, One Mind," 118–37; the role of business history in nation-building in Finland has been argued by Markku Kuisma, for example Kuisma, *Valta ja vaikutukset*, 148–50. Further on nation building and symbolism in Finnish history see Klinge, *The Finnish Tradition*; economic history see Hjerpe, *Finland's Trade and Policy in the 20th Century*; political history Jussila, Hentilä, and Nevakivi, *From Grand Duchy to Modern State*.
14. Finnish national poet J. L. Runeberg (1804–1877): "Vi Europas Förpost mot naturen/Mellan isar är vår lager skuren/Och vårt bröd vi ryckt ur is och snö." Citation in Ramsay, *Jääsaarron murtajat*, 441. All translations are by the authors unless otherwise noted.
15. This has been widely discussed among shipbuilding historians, for example see Buxton, "The Development of the Merchant Ship 1880–1990," 71–82.
16. The paddle-steamer 'City Ice Boat no 1' (1837), operated in Delaware river, Philadelphia and is considered the first special purpose icebreaking vessel. The Russian 'Pilot' (1864) was the first modern-type icebreaker with a steam-powered propeller tug. The 'Eisbrecher No. 1' (1871) assisted trade in the river Elbe to and from Hamburg. Ostersehlte, "Die geschichte des eisbrecherwesens im überlick," 109–16.
17. Häkkinen, *1860-luvun suuret nälkävuodet*, 5.
18. See Figure 1.
19. Laurell et al., *Through Ice and Snow*, 5; and Pohjanpalo, *100 vuotta*, 61–2.
20. Pihkala, *Suomen Ulkomaankauppa 1860–1917*; Fellman, "Growth and Investment," 144; Kuisma, *Metsäteollisuuden maa*, 24; Pohjanpalo, *100 vuotta*, 91–3; and Laurell et al., *Through Ice and Snow*, 5.
21. This happened concurrently on the Great Lakes, the St. Lawrence Seaway and the Atlantic coastal hubs in North America, and on the Baltic in Europe from the 1830s onwards. The understanding of the trans-Atlantic transfer of winter seafaring technology remains lacking, which may be explained by Great Britain's dominant position in late nineteenth century shipbuilding. Palmén, "Om isbrytareångfartyg och vintersjöfart," 3–19.
22. Zetterberg and Linnamäki, *Yhteisellä matkalla*, 543.
23. "Hos alla nutidens nationer gör sig nödvändigheten af ändamål[d]enliga kommunikationsanstelter gällande allt mer och mer, och en nation, som så nyss börjat lefwa som den finska, en nation, hwars nywagnade sjelfförtroende tydes berättiga till goda förhoppningar, skall wäl ide låta af misströstan och modlöshet affträda sig från de ögonblidliga uppoffringar, hwarmed den måste löpa sin framtida storhet." Article "Tankar om Finland blifvande jernvägar" in *Helsingfors Tidningar* 17.12.1861.
24. Laurell, *Höyrymurtajien aika*, 17.
25. Palmén, "Om isbrytareångfartyg och vintersjöfart," 30–3.
26. Ramsay, *Jääsaarron murtajat*, [1], 70–2, 475.
27. "[U]tan wälstånd hafwa wi ingen framtid och utan kommunikationer ernå wi intet wälstånd", in *Helsingfors Tidningar* 17.12.1861.
28. Palmén, "Om isbrytareångfartyg och vintersjöfart," 48–9; and Laati, *Suomen luotsi- ja majakkalaitoksen historia 1808–1946*, 197–8.
29. Palmén, "Om isbrytareångfartyg och vintersjöfart," 53.
30. K.A. Tawastjerna quoted in Ramsay, *Jääsaarron Murtajat*, 142.
31. Bergsunds Mekaniska Verkstadt in Stockholm, Sweden.
32. Palmén, "Om isbrytareångfartyg och vintersjöfart," 53–7; also Laurell, "Jäänmurtajat ja talviliikenne," 185–6; and Laurell et al., *Through Ice and Snow*, 19.
33. *Uusi Suometar* 3.4.1890; *Oulun Ilmoituslehti* no 37 10.5.1890; *Sanomia Turusta* no 96 26.4.1890; *Nya Pressen* no 91A. 4.4.1890.
34. Ramsay, *Jääsaarron Murtajat*, 153; *Nya pressen* 3.4.1890; *Savo-Karjala* 9.4.1890 no 40; *Päivälehti* 3.4.1890.
35. *Komiteebetänkande* 1896 no 1, Bilaga III, 153.
36. Between 1890 and 1895 Finnish butter export increased from 4094 t to 11,330 t and the share of Hanko as the butter export port increased from 51 to 92%. Pohjanpalo, *100 vuotta*, 114.

37. “Murtaja tulee taistelemaan talven kanssa ja voittamaan sen vallan. Sentähden se onkin meidän ystävä”. *Päivälehti* 16.12.1890.
38. Founded in 1880 Teknologiska föreningen i Finland (TFiF) was comprised of predominantly Swedish speaking engineers with substantial international experience. Like similar associations in the UK and US, it published a long-running series of proceedings *TFiF Förhandlingar*, where Finnish shipbuilders found a venue for publishing papers on icebreaking technology prior to 1950s.
39. He was the son of the Finnish national poet quoted at the start of the chapter and the designer of the ‘Expressen’.
40. Bonsdorff had experience from Danish, Swedish and Russian shipyards, while Eager had been born in Plymouth, England and ended up as constructor of the leading Finnish shipyard, Crichton after a stint in Russia. For both, see biographical notes in folder 21, Henrik Ramsay private archive, FNA; Runeberg had worked in the UK and France, see Holmström, “Banbrytaren inom vintersjöfarten,” 8–24.
41. Palmén was initially published in the *TFiF Förhandlingar* but also soon as a separate print as well; Runeberg, “Om möjligheten af en vinternavigation till S:t Petersburg,” 68–72.
42. Bonsdorff’s description of his trip, see *Komitébetänkande* 1896 no 1, Bilaga II, 122–38.
43. Johnson, “Development of Ice-breaking Vessels for the U.S. Coast Guard,” 127; correspondence with Hudson River Navigation Corporation, folder 21, Henrik Ramsay private archive, FNA.
44. For example, see Warren, *Armstrongs of Elswick*.
45. Delivered in 1897 and named after the mythical wealth-creating machine from the Finnish national romantic epic *Kalevala* by Elias Lönnrot.
46. *Uusi Suometar* 9.3.1888; *Savo-Karjala* 9.4.1890; *Suomi* 9.4.1890.
47. Michelsen and Kuisma, “Nationalism and Industrial Development in Finland,” 346.
48. Report *Skeppsbyggerikomiteén* (1912) s. 71–9, 95–6; Krogus at the first Finnish maritime cluster congress in 1925 “Suomen ensimmäinen Merenkulku- ja Laivanrakennuskongressi,” 9–10 in *Suomen merenkulku ja laivanrakennusteollisuus*; and Laurell et al., *Through Ice and Snow*, 35.
49. Trade and industry minister Aukusti Aho in a meeting with leading industrialists, shipping companies and maritime specialists, 28 February 1923, Ea:34, Incoming documents, Ministry of Trade and Industry, FNA.
50. For an example on the world leader, Britain, see Johnman and Murphy, *British Shipbuilding and the State since 1918*.
51. Finska Ångfarts Aktiebolaget or increasingly in Finnish Suomen Höyrylaiva Osakeyhtiö. For reasons of brevity we will use the acronym FÅA.
52. Also the author of *Jääsaarron murtajat*.
53. Suviranta, *Suomen höyrylaiva osakeyhtiö, 1883–1958*, 75, 81–2, 87–9; Kaukiainen and Leino-Kaukiainen, *Navigare Necesse*, 110–1.
54. Fellman, “Growth and Investment,” 155–7; Heikkinen, *Paperia Maailmalle – Suomen paperitehtainten yhdistys Finnpap 1918–1996*, 33, 40–1, 59–4; and Ramsay, *Jääsaarron Murtajat*, 308.
55. Печенга, Pechenga.
56. Linhammar.
57. The icebreaker ‘Tarmo’ survives as a museum ship in the Maritime Museum of Finland, where this story is still routinely repeated to thousands of visitors yearly. The ship still draws media attention, and while working at the museum centre, one of the authors was interviewed by Finnish national TV on the history of the ship. See also: Mattila, “Jäänmurtajat Vapaussodassa,” *Navigators* 5/59; “Vanha kunnon Tarmo in memoriam,” *Navigators* 9/69; museum leaflet *Jäänmurtaja Tarmo: Kantasatama, Kotka*.
58. Minutes for the 28 February 1923 meeting at the Ministry of Trade and Industry, Ea:34, Saapuneet kirjeasiakirjat, Kauppa- ja teollisuusministeriö, FNA; Johansson had studied naval architecture at Chalmers due to the troubles over conscription in Finland in 1905, see Holmström, “K. Albin Johansson,” 81–5; Karttunen, Pietikäinen, and Suopanki, *Uljaksen vanavedessä*, 192–3.

59. Notebook titled '*Hansa*' polemik and other collected papers in folder A97004:040-047, K. Albin Johansson personal archive, FMM.
60. Memoranda regarding the tender, Ea:34, FNA; Finnish cabinet meetings 23 February and 20 March 1923, Ca:51–52 Cabinet minutes III, FNA; MKH directors meetings in 5 May, 1 and 11 June, and 12 December 1926, Ca:17, MKH Archive, FNA; Ramsay, 315; Laurell, 140–2; Kaukiainen and Leino-Kaukiainen, 110; N1973, N5000, FO371/10425, TNA.
61. The minutes and presentations were printed in the booklet *Suomen merenkulku ja laivanrakennusteollisuus: muutamia päivänpolttavia kysymyksiä: Turussa helmikuun 20 ja 21 p:nä 1925 pidetyssä merenkulku- ja laivanrakennuskongressissa esitetyt esitelmät, alustukset ja selostus keskusteluista*.
62. *Suomen merenkulku ja laivanrakennusteollisuus*, 12–6.
63. *Suomen merenkulku ja laivanrakennusteollisuus*, 141–4.
64. Jääsalo, *Pohjoisen satamat auki*, 56–7.
65. Generally meaning a distinctively Finnish national quality of perseverance and fortitude.
66. Navy motion for a combined icebreaking and submarine tendering ship 25 November 1932, PLM-26 F:87 Secret correspondence, Ship construction department, DoD, FNA; Maritime administration minutes 13 December 1932, 25 March 1933, Ca:28–29, MKH, FNA; MKH memoranda in 1933, Eb:33 incoming correspondence, MKH, FNA; tender to Crichton-Vulcan shipyard 17 January 1933 on the ship with Atlas Diesel and Brown & Boveri specifications, Hc:1, Ship construction department, DoD, FNA; previously unseen tender committee papers in Eb:74 Incoming correspondence, MKH, FNA; "A diesel-electric ice breaker: the 'Sisu' a dual-purpose 4,000 s.h.p. triple-screw vessel for the Finnish government," in *The Motor Ship* 1939:4; Ramsay, 338–46; Pohjanpalo, 159–62; Kaukiainen and Leino-Kaukiainen, 115–7, 119; Kivikuru, "Sukellusveneiden emälaivan tehtävistä," *Laivastolehti* 3/39; Rahola, "Jäänmurtaja Voima ja sen neljä potkuriä," *Suomen laivasto* 2/1954.
67. After a Norse mythological proto-god, launched in 1933.
68. The Swedish maritime administration invited Finnish colleagues to visit the ship in 1933 and later again in 1936. K. A. Johansson, at least, was among the visitors. "9,000 B.H.P. machinery for a diesel-electric ice-breaker," in *The Motor Ship*, January 1933; Liljeblad, "The Swedish Government's Ice-breaker 'Ymer'"; and Johnson, "Development of Ice-breaking Vessels for the U.S. Coast Guard".
69. Ramsay was imprisoned as a war criminal at the time, Niku *Kahdeksan tuomittua miestä*, 25–7, 181.
70. The title translates as 'In battle with Baltic ice'.
71. While Ramsay was well versed in ships and shipping, we have concluded that he relied solely on Johansson in matters of icebreaking technology and the two were on very good terms indeed. Original notes and correspondence on the book are retained in Folder 21, Henrik Ramsay private archive. FNA; "Talvimerenkulku oli edellytyksenä – välttämättömänä edellytyksenä – Suomen elinkeinoelämän, niin, jopa sivistyksen edistymiselle", 78 Ramsay, *Jääsaarron Murtajat*, 42,78, 147.
72. Jääsalo, *Pohjoiset satamat*, 277.
73. Pohjanpalo, 100 vuotta, describes the 1970s official doctrine with distinct empathy, 349–354: "Jäänmurtajatoiminnan tavoitteena on kaikkien talvisatamien aukipitäminen ympäri vuoden, myös ankarina talvina, jolloin lähes koko Itämeri saattaa olla jäänpeittämä ... [j]äänmurtajalaivastoa joudutaan tämän takia hiukan ylivoimaisesti leutojen talvien olosuhteista katsottuna."
74. Paavonen, "Special Arrangements for the Soviet Trade in Finland's Integration Solution," 153–68; Aunesluoma, *Vapaakaupan tiellä*, 189–279; and Jensen-Eriksen, *Metsäteollisuuden maa 4*, 97–146.
75. Jensen-Eriksen, *Metsäteollisuuden maa 4*, 102–14, 146–7; Aunesluoma, *Vapaakaupan tiellä: Suomen kauppa- ja integraatiopolitiikka maailmansodista EU-aikaan*, 92–101.
76. Jääsalo, *Pohjoisen satamat*, 246.

77. Finnish paper producers association to FMA 7 January 1946, FMA director to the Ministry of trade and industry 14 January 1946, and FMA answer to the paper producers 22 January 1946, all in Eb:362, MKH, FNA.
78. Sundman had until 1938 been the navy chief of staff. He was instrumental in bringing naval influences to MKH as the administration director 1938–1945 and as the ministry supervisor from thereafter until 1965. For discussion and sources see Uola, “Sundman, Svante (1895–1969)”; Sundman to the maritime administration 12 February 1946, in Eb:362, MKH, FNA; Letter from the Minister of trade and industry to MKH, 8 August 1952. Eb:414, MKH, FNA; The committee report, Jäänsärkijätoimikunnan mietintö, 37.
79. The ship was named after the 1924 ship lost to reparations. The committee had proposed a new name for this ship, ‘Into,’ meaning enthusiasm, but more conservative attitudes prevailed.
80. Shaft horsepower (shp) is used as the unit of measurement of an icebreakers’ power as various tonnage or displacement measurements are meaningless on such a ship.
81. Johansson fought this new and largely unknown design but the shipyard designers pushed for it and were backed by the MKH director. The Canadian ferry *Abegweit* launched in 1946 was an influence on the twin bow propeller design. MKH correspondence with various ministries and interest groups regarding the icebreaker issue in 1946, Eb:362 MKH, FNA; planning of the new state icebreaker, Eb:363 MKH, FNA; MKH director Rahola to ministry of trade and industry on the ship design 3 April 1948, Eb:414 MKH, FNA; Designing and constructing the ‘Voima,’ A97004: 064, 1148–1150 K. A: Johansson papers, FMM; Johansson’s undated letter to Ramsay around 1946–1947, Folder 21, Henrik Ramsay private archive, FNA.
82. Landtman, *Minnen från mina år vid Wärtsilä*, 293; Haapavaara, *Martin Saarikangas*, [1], [24], 285; Christian Landtman interviews 21 January 2014 & 9 September 2014; Martin Saarikangas interview 5 February 2014.
83. For example, in 1970s, an acquisition of a Finnish icebreaker to the USCG was widely discussed as a political tool to support Finnish western orientation. Even though the order was never realized, in the related discussion the Finnish icebreakers were presented as a prime example of Finnish technological development; Documents related to the President Urho Kekkonen’s visit to the USA 1975, NSA NCS Europe, Canada, and Ocean Affairs staff. Country File, USSR – Soviet Jewry, 1974, Gerald Ford Library, Ann Arbor, MI. “Sales-Minded Finns giving Ford Dinner on an icebreaker,” *New York Times*, 31 July 1975.
84. The board was comprised of politician, bureau chiefs and economic specialists. MKH was consulted but not directly part of the research committee, see *Tutkimus talviliikenteestä*, III–XI, 94–7.
85. This includes war reparations to the Soviet Union, infrastructure rebuilding, relocation of dispossessed population, and economic planning. Heikkilä and Tiihonen, *Kriisinselvittäjä*.
86. *Tutkimus talviliikenteestä*, 94–5: “Valtion intressiin tuntuisi siis ehdottomasti kuuluvan puuttua tähänastista aktiivisemmin talviliikenteen hoitoon. Kun periaatteellista vastustusta ei ilmeisesti esiinny eri osapuolten taholta, kysymys lienee lähinnä keinoista, joilla saavutettaisiin koko kansantalouden kannalta paras lopputulos.”
87. The other three (not two as planned) were smaller and meant for the extensive archipelago.
88. Tamminen, “Kulkulaitoksemme talviliikenne tutkimuksen valossa,” *Navigator* 2/1956; Rahola, “Talviliikenteemme kehityksestä ja nykyhetken ongelmista,” *Navigator* 4–5/1958; on the effects of eliminating seasonal variation see, Bergholm, Tapio “Port Traffic and Structural Change in the Finnish Economy and Transport Network in the Twentieth Century,” 225–38 in *International Journal of Maritime History* 19:1.
89. Haapala, “The Fate of the Welfare State,” 144–5.
90. Kekkonen, *Onko maailmamme malttia vaurastua*, 128–9; and Mäntylä, *Pohjois-Suomea kehittämässä*, 319–28.
91. E.g. Jääsalo, *Pohjoisen satamat*, 67, 126–34, 160–72.
92. Beckman, “Talvimerenkulku ja jäävahingot,” *Navigator* 1/1972: “Jos jo etukäteen tiedetään, että matkaa johonkin ahtojäävalliin takana olevaan satamaan ei voida suorittaa muuten kuin turvautumalla jäänmurtajan hinauksen, ja jos tällöin myös tiedetään että alukselle varmasti tulee suuria jäävahinkoja, ollaan arveluttavan lähellä sitä rajaa, jolloin ei enää voida puhua

vakuuttamiskelpoisesta vaarasta”; also Beckman, “Jäävahingot lisääntyneet”, *Navigator* 12/1971.

93. Fittingly, his surname can be translated as ‘ice wilderness’.
94. Jääsalo, *Pohjoisen satamat*, 7–14.
95. Kaukiainen and Leino-Kaukiainen, *Navigare necesse*, 321.
96. Compare the following reports: Council of transportation systems chaired by Kalervo Tamminen (“Tutkimus talviliikenteestä,” Kulkulaitosneuvoston julkaisuja 1957); Port Committee chaired by Svante Sundman (“Satamakomitean mietintö,” Komiteamietinnöt 1958); Bank of Finland Research center (Kukkonen & Tikkanen, “Jäänmurtajat ja Talviliikenne”); and the articles publishes in *Navigator*: Niini “Talvimerenkulku on maamme elinehto” (1/67); Johansson, “Talvimerenkulun ongelmat” (5/67); Forsskähl, “Perämeren talviliikenne” (1/68); Jääsalo, “Suomalaiset jäänmurtajat Itämeren talviliikenteessä” (1/68); Teräs, “Erikoisvaatimukset, jotka talvimerenkulku asettaa satamille” (9/68); Pohjanpalo, “Jäänmurtajat talviliikenteen tukipylväinä” (3/69); Kaste, “Talviliikenteen kehityksestä” (2/69); Beckman, “Jäävaaran vakuuttamisesta” (3/69); Rekola, “Rautatie- ja meriliikenteen yhtymäkohdat Pohjois-Suomessa” (11/69); Becker, “Perämeren merkuljetukset linjaliikenteen näkökulmasta” (11/69); Kaste, “Valtionrautatiet ja talviliikenne” (2/70).
97. “[...] kuinka näennäisesti luotettavien tuntuksilla numeroilla voidaan omia näkökohtia perustella “unohtamalla sievästi” joitakin asiaan vaikuttavia tekijöitä,” article “Talvimerenkulun ongelmat,” in *Navigator* 1/73.
98. Kukkonen and Tikkanen, “Jäänmurtajat ja Talviliikenne”.
99. Jääsalo, *Pohjoisen satamat*, 99–101; Kaukiainen and Leino-Kaukiainen, *Navigare necesse*, 321.
100. Some 20 in total. Small ports have always been seasonal. Port historian Tapio Bergholm to the authors.
101. Kukkonen and Tikkanen, “Jäänmurtajat ja talviliikenne”.
102. Named after the Finnish president Urho Kekkonen but also meaning someone brave or a hero.
103. The share of winter shipping between December and April was in 1930s 18%, in 1950s 21% and in the end of 1970s 40%. Kaukiainen, *Ulos maailmaan!*, 438; Kaukiainen and Leino-Kaukiainen, *Navigare necesse*, 235, 320–4.
104. Jääsalo, “Suomalaiset jäänmurtajat Itämeren talviliikenteessä,” in *Navigator* 1/1968: “Mitä rohkeat yrittävät olivat panneet alulle, se jäi nyt taloudellisesti ja teknillisesti ajattelevien miesten edelleen kehitettäväksi”.
105. The Finnish-Swedish cooperation included conferences on ice research and other joint research projects. Haviskonferens I Stockholmn 3–4.10.1972, Protokoll, Stryelsen för Vintersjöfartsforskning, Forskningsrapport nr. 1. 1972; “Talvimerenkulkuun liittyviä ongelmia käsiteltiin Luulajassa,” *Navigator* 10/1971; “Suomalais-Ruotsalaiset jääluokkasäännöt astuvat voimaan 1.5.1971,” *Navigator* 4/1971.
106. Jääsalo, *Pohjoisen satamat*, 58–9.
107. Ojala and Kaukiainen, “Finnish Shipping”; Kaukiainen and Leino-Kaukiainen, *Navigare necesse*, 326.
108. Pohjanpalo was the leading specialist in maritime traffic, the long serving editor of industry journal *Navigator*, and a proponent of Ramsay’s ideas, see Pohjanpalo, *100 vuotta*.
109. Ramsay, *Jääsaarron Murtajat*, 10; and Pohjanpalo, *100 vuotta*.
110. Michelsen and Kuisma, “Nationalism and Industrial Development in Finland,” 343–53.
111. Jensen-Eriksen, “Business, Economic Nationalism and Finnish Foreign Trade during the 19th and 20th Centuries,” 47–9.
112. Michelsen, *Valtio, teknologia, tutkimus*, 48, 51; and Myllyntaus, “The Finnish Model of Technology Transfer,” 625–43.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

Saara Matala's work has been funded by the Doctoral School Program in the Aalto University School of Engineering. Aaro Sahari's work has been supported by the Kone Foundation doctoral research grant and project funding for exchange and research in the UK; the Jenny and Antti Wihuri Fund doctoral research grant; the Kymi Corporation Centennial Fund for archival research; and the Kulturfonden för Sverige och Finland grant for research in Sweden.

ORCID

Saara Matala  <http://orcid.org/0000-0003-3571-1825>
Aaro Sahari  <http://orcid.org/0000-0002-5099-8249>

References

Archival sources

Cabinet Minutes. Finnish National Archives [FNA], Helsinki.
Department of Defence Ship Construction Department Archives [Laivanrakennusosasto]. FNA, Helsinki.
Finnish Board of Navigation Archive [Merenkulkuhallitus, MKH]. FNA, Helsinki.
Foreign Office Archives, The National Archives [TNA], London.
Gerald Ford Library, Ann Arbor, MI.
Henrik Ramsay Private Archive. FNA, Helsinki.
K. Albin Johansson Private Archive. Finnish Maritime Museum, Kotka.
Ministry of Trade and Industry Archive [Kauppa- ja teollisuusministeriö]. FNA, Helsinki.

Oral history sources

Landtman, Christian. Interviews by Authors Jan 21 2014 (AS), and Sep 9 2014 (AS and SM).
Saarikangas, Martin. Interview by Author (SM) Feb 5 2014.

Online sources

Tekes – The Finnish Funding Agency for Innovation Meanwhile in Finland Campaign Featuring the Dudesons.
Uola, Mikko. "Sundman, Svante." *Finnish National Biography Online*. URN:NBN:fi-fe20051410.

Bibliography

Aunesluoma, Juhana. *Vapaakaupan tiellä: Suomen kauppa- ja integraatiopolitiikka maailmansodista EU-aikaan* [On the Road to Free Trade: Finnish Trade and Integration Policy from the World War to EU]. Helsinki: Suomalaisen Kirjallisuuden Seura, 2011.
Buxton, I. L. "The Development of the Merchant Ship 1880–1990." *The Mariner's Mirror* 79, no. 1 (1993): 71–82.
Fellman, Susanna. "Growth and Investment: Finnish Capitalism, 1850–2005." In *Creating Nordic Capitalism: The Business History of a Competitive Periphery*, edited by Susanna Fellman, Martin Iversen, Hans Sjögren, and Lars Thue, 139–217. Houndsmill: Palgrave Macmillan, 2008.
Fridlund, Mats. "De nationalistiska systemen: konstruktion av teknik och svenskhet kring sekelskiftet 1900." [The National System: Construction of Technology and Swedishness Around the Turn of the 21st Century.] In *Den konstruerade världen: Tekniska system i historiskt perspektiv* [The Constructed World: Technological System in a Historic Perspective], edited by Pär Blomkvist, and Arne Kaijser, 77–103. Stockholm: Symposion, 1998.

- Fritzsche, Peter. *A Nation of Fliers: German Aviation and the Popular Imagination*. Cambridge, MA: Harvard University Press, 1992.
- Från Komitén för frågan om åtgärder för vintertrafikens säkerställande komitébetänkande* [From the Committee on the Reliability of Winter Navigation]. Grand Duchy of Finland Senate Committee 1896:1. Helsingfors: Edlundska bokhandeln, 1896.
- Haapala, Pertti. "The Fate of the Welfare State." *Historiallinen aikakauskirja*, no. 2 (1998): 142–149.
- Haapavaara, Heikki. *Martin Saarikangas: Iso-Masa, laivanrakentaja* [Martin Saarikangas: the Shipbuilder]. Helsinki: Gummerus, 2002.
- Hecht, Gabrielle. "Planning a Technological Nation: Systems Thinking and the Politics of National Identity in Post-War France." In *Systems, Experts and Computers: The Systems Approach in Management and Engineering, World War II and After*, edited by Agatha C. Hughes, and Thomas Parke Hughes, 133–160. Cambridge, MA: MIT Press, 2000.
- Hecht, Gabrielle. *The Radiance of France: Nuclear Power and National Identity after World War II*. Cambridge, MA: MIT press, 2009.
- Hecht, Gabrielle, and Michael Thad Allen. "Introduction: Authority, Political Machines, and Technology's History." In *Technologies of Power: Essays in Honor of Thomas Parke Hughes and Agatha Chipley Hughes*, edited by Michael Thad Allen, and Gabrielle Hecht, 1–23. Cambridge, MA: MIT Press, 2001.
- Heikkinen, Sakari. *Paperia maailmalle: Suomen paperitehtaitten yhdistys – Finnmap 1918–1996* [Paper to the World: Finnish Paper Manufacturers Association Finnmap 1918–1996]. Helsinki: Otava, 2000.
- Heikkinen, Sakari, and Seppo Tiihonen. *Valtiovarainministeriön historia. 2, Kriisinselvittäjä: 1917–1966* [History of the Finnish Ministry of Finance, Part 2]. Helsinki: Edita, 2009.
- Hjerpe, Riitta. *Finland's Trade and Policy in the 20th Century*. Helsinki: Valtiovarainministeriö, 1993.
- Holmström, John. "Banbrytaren inom vintersjöfarten: om Jakob Robert (Ivanovitj) Runeberg." [Forerunner in Winter Navigation: On Jakob Robert Runeberg.] In *Finlandssvenska tekniker: Det fjärde bandet*. Vol. 4, 8–24. Helsingfors: Tekniska föreningen i Finland, 2003.
- Holmström, John. "K. Albin Johansson: den kontroversiella och egenmäktiga isbrytar- och varvskonsulten." [K. Albin Johansson: The Controversial and Obstinate Icebreaker and Dock Consultant.] In *Finlandssvenska tekniker. Det sjätte bandet, Framtidsbyggare* [Finnish-Swedish Engineers: The Sixth Volume, Future Builders], edited by Johan Stén. Helsingfors: Tekniska föreningen i Finland, 2007.
- Hughes, Thomas. *American Genesis: A Century of Invention and Technological Enthusiasm, 1870–1970*. Chicago, IL: University of Chicago Press, 2004.
- Hughes, Thomas. "The Evolution of Large Technological Systems." In *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, edited by Wiebe E. Bijker, Thomas P. Hughes, and Trevor J. Pinch, 51–82. Cambridge, MA: MIT Press, 1989.
- Hughes, Thomas. *Rescuing Prometheus: Four Monumental Projects that Changed the Modern World*. New York: Pantheon, 1998.
- Hughes, Thomas. "The Seamless Web: Technology, Science, Etcetera, Etcetera." *Social Studies of Science* 16, no. 2 (1986): 281–292.
- Häkkinen, Antti. *1860-luvun suuret nälkävuodet: tutkimus eri väestöryhmien mielialoista ja toimintamalleista* [The Great Famine of 1860s: Research into Modes of Action in Various Population Groups]. Helsinki: Helsingin yliopisto, 1989.
- Jäänmurtaja Tarmo: Kantasatama, Kotka* [Icebreaker Tarmo: Inner Harbour, Kotka]. Kotka: Kymenlaakson museo, 1993.
- Jääsalo, Helge. *Pohjoiset satamat auki* [Northern Ports Opened]. Oulu: Pohjoinen, 1980.
- Jensen-Eriksen, Niklas. "Business, Economic Nationalism and Finnish Foreign Trade during the 19th and 20th Centuries." *The French Economic History Review*, no.3 (2015): 40–57.
- Jensen-Eriksen, Niklas. *Metsäteollisuuden maa: 4, läpimurto: metsäteollisuus kasvun, integraation ja kylmän sodan Euroopassa 1950–1973* [The Land of Forestry Vol. 4: Breakthrough 1950–1973]. Helsinki: Suomalaisen Kirjallisuuden Seura, 2007.
- Johnman, Lewis, and Hugh Murphy. *British Shipbuilding and the State since 1918: A Political Economy of Decline*. Exeter: University of Exeter Press, 2002.

- Josephson, Paul. *The Conquest of the Russian Arctic*. Cambridge, MA: Harvard University Press, 2014.
- Jussila, Osmo, David Arter, Eva-Kaisa Arter, Seppo Hentilä, and Jukka Nevakivi. *From Grand Duchy to Modern State: A Political History of Finland since 1809*. London: Hurst, 1999.
- Karttunen, Ilkka, Matti Pietikäinen, and Marja-Liisa Suopanki. *Uljaksen vanavedessä: John Nurmisen kauppahuoneen ja varustamon historiaa 1886–1967: miehiä, laivoja, elämää JN-lipun alla* [In the Van of Uljas: History of John Nurminen Trade House and Shipping Company 1886–1967]. Helsinki: John Nurmisen Säätiö, 2006.
- Kaukiainen, Yrjö. *Ulos maailmaan! Suomalaisen merenkulun historia* [Out to the World!: History of Finnish Seafaring]. Helsinki: Suomalaisen kirjallisuuden seura, 2008.
- Kaukiainen, Yrjö, and Pirkko Leino-Kaukiainen. *Navigare necesse: Merenkululaitos 1917–1992* [History of the Finnish Board of Navigation 1917–1992]. Helsinki: Merenkululaitos, 1992.
- Kekkonen, Urho. *Onko maallamme malttia vaurastua?* [Does Our Country Have the Patience to Grow Rich?] Helsingissä: Otava, 1952.
- Klinge, Matti. *The Finnish Tradition: Essays on Structures and Identities in the North of Europe*. Helsinki: Suomen historiallinen seura, 1993.
- Kuisma, Markku. *Metsäteollisuuden maa: 1, Metsäteollisuuden maa: Suomi, metsät ja kansainvälinen järjestelmä 1620–1920* [The Land of Forestry Vol. 1: Beginnings 1620–1920]. 2nd ed. Helsinki: Suomalaisen Kirjallisuuden Seura, 2006.
- Kuisma, Markku. “Valta ja vaikutukset: yrityshistorian uusia mahdollisuuksia.” [Power and Effects: New Possibilities in Business History.] In *Historia nyt: näkemyksiä suomalaisesta historian tutkimuksesta*, edited by Pekka Ahtiainen, et al. Historiallisen yhdistyksen julkaisuja, no. 5, 1990.
- Kukkonen, Pertti, and Esko Tikkanen. *Jäänmurtajat Ja Talviliikenne*. Helsinki: Bank of Finland, 1970.
- Laati, Iisakki. *Suomen luotsi- ja majakkalaitoksen historia 1808–1946*. Helsinki: Merenkulkuhallitus, 1946.
- Landtman, Christian. *Minnen från mina år vid Wärtsilä* [Memories from My Time with Wärtsilä]. Helsinki: Self-published, 2011.
- Laurell, Seppo. *Höyrymurtajien aika: historiikki höyrykäyttöisten valtionjäänmurtajien aikakaudesta* [The Era of Steam Icebreakers: History of Steam Driven State Icebreaker Period]. Helsinki: Merenkulkuhallitus, 1992.
- Laurell, Seppo, Erkki Riimä, and Elwa Sandbacka. *Through Ice and Snow: The Story of Finnish Winter Navigation*. Helsinki: Ship Historical Society of Finland, 1985.
- Matala, Saara. “Läpi kylmän sodan ja jään: suomalaisesta jäänmurrosta kansainväliseksi teollisuudeksi 1950–1989.” *Tekniikan Waiheita* [Finnish Quarterly for the History of Technology] 33, no. 2 (2015): 5–25.
- Michelsen, Karl-Erik. *Valtio, teknologia, tutkimus: VTT ja kansallisen tutkimusjärjestelmän kehitys* [The State, Technology, Research: Development of the Finnish National Research System]. Espoo: Valtion teknillinen tutkimuskeskus, 1993.
- Michelsen, Karl-Erik. *Viides sääty: insinöörit suomalaisessa yhteiskunnassa* [The Fifth Estate: Engineers in the Finnish Society]. Helsinki: Tekniikan akateemisten liitto, 1999.
- Michelsen, Karl-Erik, and Markku Kuisma. “Nationalism and Industrial Development in Finland.” *Business and Economic History* 21 (1992): 343–353.
- Myllyntaus, Timo. *Electrifying Finland: The Transfer of a New Technology into a Late Industrialising Economy*. London: Macmillan, 1991.
- Myllyntaus, Timo. “The Finnish Model of Technology Transfer.” *Economic Development and Cultural Change* 38, no. 3 (1990): 625–643.
- Mäntylä, Matti. *Pohjois-Suomea kehittämässä: periferia Urho Kekkosen politiikan kohteena ja vallankäytön välineenä vuosina 1950–1981* [Developing Northern Finland: Periphery in Urho Kekkonen’s Politics and Policy 1950–1981]. Rovaniemi: Pohjois-Suomen Historiallinen Yhdistys, 2016.
- Niku, Risto. *Kahdeksan tuomittua miestä: sotasyölysten vankilavuodet* [Eight Convicted Men: War Criminals’ Time in Prison]. Helsinki: Edita, 2005.
- Ojala, Jari, and Yrjö Kaukiainen. “Finnish Shipping – A Nordic Exception?”. In *Global Shipping in Small Nations: Nordic Experiences after 1960*, edited by Stig Tenold and Martin Jes Iversen, 129–155. London: Palgrave Macmillan, 2012.

- Ostersehlte, Christian von. "Die Geschichte des Eisbrecherwesens im Überblick: von den Anfängen und der Entwicklung des ersten Ausgereiften Eisbrechers in Hamburg bis zur Gegenwart." [The History of Icebreaking: From the Beginning and the Development of the First Mature Icebreaker in Hamburg to the Present.] *Deutsches schiffahrtsarchiv* 9, no. 6 (1983): 109–116.
- Paavonen, Tapani. "Special Arrangements for the Soviet Trade in Finland's Integration Solution – A Consequence of Finland's International Position or Pursuit of Profit?" In *East-West Trade and the Cold War*, edited by Eloranta, Jari and Jari Ojala, 153–168, University of Jyväskylä, 2005.
- Palmén, K. E. *Om isbrytareångfartyg och vintersjöfart* [On Icebreakers and Winter Navigation]. Helsingfors: Tekniska föreningen, 1894.
- Pihkala, Erkki. *Suomen ulkomaankauppa 1860–1917* [Finnish Foreign Trade 1860–1917]. Helsinki: Suomen Pankki, 1969.
- Pohjanpalo, Jorma. *100 Vuotta Suomen Talvimerenkulkua* [100 Years of Finnish Winter Navigation]. Helsinki: Valtion painatuskeskus, 1978.
- Pulkkinen, Tuija. "One Language, One Mind: The Nationalist Tradition in Finnish Political Culture." In *Europe's Northern Frontier: Perspectives on Finland's Western Identity*, edited by Philip Landon, and Tuomas M. S. Lehtonen, 118–137. Jyväskylä: PS-kustannus 1999.
- Ramsay, Henrik. *Jääsaaron murtajat: Suomen talvimerenkulun historiaa* [Breakers of Ice Embargo: History of Finnish Winter Navigation]. Translated by Jukka Rangell. Porvoo: WSOY, 1949.
- Russell, Mark A. "Steamship Nationalism: Transatlantic Passenger Liners as Symbols of the German Empire." *International Journal of Maritime History* 28, no. 2 (2016): 313–334. doi:10.1177/2F0843871416637587.
- Satamakomitean mietintö. (Port Committee chaired by Svante Sundman: Report). Komiteamietinnöt 8. Helsinki: Valtioneuvosto, 1958.
- Skeppsbyggerikomiteén: betänkande rörande åtgärder för den inhemska skeppsbyggerinäringens höjande [Shipbuilding Committee: Report on the Development of Domestic Industry]. Grand Duchy of Finland Senate Committee. Helsingfors: Senaten, 1912.
- Suomen merenkulku ja laivanrakennusteollisuus: muutamia päivänpolttavia kysymyksiä: Turussa helmikuun 20 ja 21 p:nä 1925 pidetyssä merenkulku- ja laivanrakennuskongressissa esitetyt esitelmät, alustukset ja selostus keskusteluista* [Finnish Navigation and Shipbuilding: Pressing Issues: Presentations and Discussion at the First Finnish Maritime Congress In February 20–21 1925]. Turku, 1925.
- Suviranta, Bruno. *Suomen höyrylaiva osakeyhtiö, 1883–1958* [Finnish Steamship Company, FÅA, 1883–1958]. Helsinki, 1958.
- Sörlin, Sverker. *Framtidslandet: debatten om Norrland och naturresurserna under det industriella genombrottet* [Land of the Future: The Debate on Norrland and Natural Resources During Industrialisation]. Stockholm: Carlssons, 1988.
- Talvio, Tuukka. *Suomen rahat* [Finnish Coins and Bills]. 3rd ed. Helsinki: Suomen Pankki, 2003.
- Turunen, Ari, and Petja Partanen. *Raakaa voimaa: suomalaisen jäänmurtamisen tarina* [Raw Power: The Story of Finnish Icebreaking]. Helsinki: Kulttuuriosuuskunta Vehrä, 2013.
- Tutkimus talviliikenteestä* [Research into Winter Transportation]. Helsinki: Kulkulaitosneuvosto, 1957.
- Warren, Kenneth. *Armstrongs of Elswick: Growth in Engineering and Armaments to Merger with Vickers*. Houndmills: MacMillan Press, 1989.
- Zetterberg, Seppo. *Yhteisellä matkalla: VR 150 vuotta* [Getting There Together: 150 Years of Finnish State Rail]. Helsinki: WSOY, 2011.